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# Flight System Testbed Presentation

5/10/01

Lee Mellinger

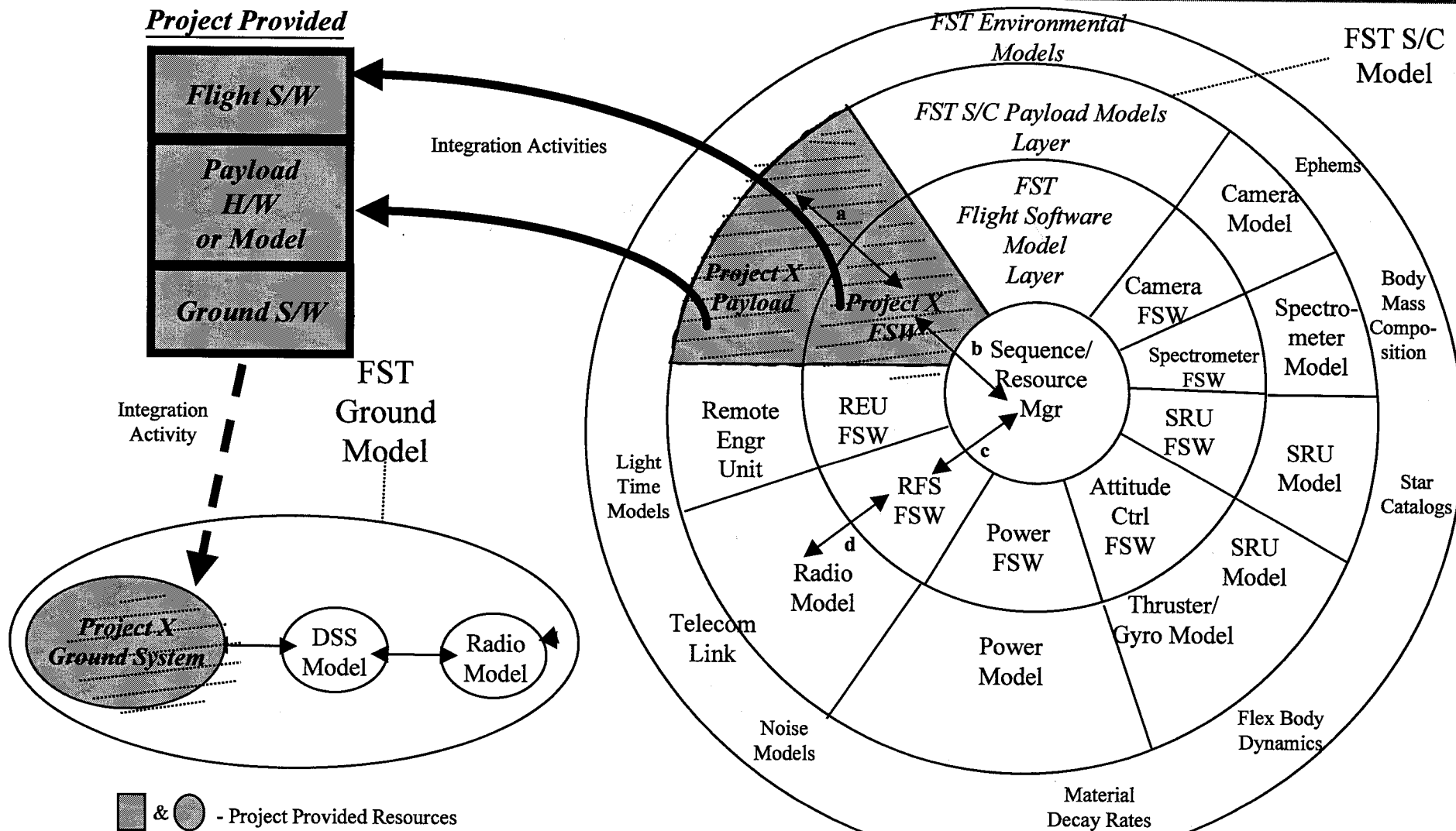


# FST Description

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- The FST acts as an institutional testbed incubator and provides key technical expertise to projects.
- Enables early Pre-CDR system validation, design trades and new technology infusion.
- Provides an environment where end-to-end system operability issues can be evaluated.
- System interfaces can be verified early in the design process.

# FST Mission System Prototype





# Prototype Components

Mission Functional Components		Implementation Elements				
		Mission Software	Mission Hardware	Support Equipment		Models
				Hardware	Interface Software	
Avionics	ACS	Attitude Estimation Attitude Control	Flight Computer (e.g., RAD6000), Memory, Remote Engineering Unit, Data Bus (e.g., MIL-STD-1553, 1394), Avionics Bus (e.g., VME, PCI)	Waveform Generator, 1553 Remote Terminal, Vmetro (VMEbus Analyzer)	Remote Terminal Driver, 1553 monitor, S/C attitude error visualization	Gyro, Star Scanners, Sun Sensors, Spin Detectors, Reaction Wheels
	CDS	Commanding, Persistent Storage, Telemetry Management, CCSDS Remote Engineering Unit			Onboard command queue visualization	N/A
Telecom		RF System Monitor and Control	Data I/F (e.g., RS-232), Control I/F (e.g., MIL-STD-1553)	RS-232 Port, 1553 Remote Terminal	Serial Driver, Remote Terminal Driver, Radio configuration gui	DSN, Spacecraft Antenna, Spacecraft Transponder, Spacecraft Command Detector Unit, Spacecraft RF Amplifier, Spacecraft Telemetry Modulation Unit, Spacecraft Hardware Command Decoder Spacecraft Reed Solomon Downlink
Thermal		TBD	TBD (e.g., Thermister Heater)	TBD	TBD	TBD (e.g., TRASYS, SINDA)
Propulsion		Main Engine Burn Controller	TBD (e.g., Fuel Tank)	Cold Gas thruster assembly	Cold Gas thruster assembly drivers	Main Engine, Thrusters, Fuel SLOSH Fuel Consumption
Power and Pyro		PDU Control	PDU, Power Supply	Power Load Board, Electronic Load	Power Load Driver, VXI Driver	Solar Array, NiCd Battery, RTG, Shunt Regulator
Payload		Instrument Control	I/F Electronics (e.g., RS-422, MICAS I/F), Camera	RS-422 Port, RGB Monitor	Web-based Image Viewer, RS422 Serial Drivers	Camera Optics, Camera Detector, Camera Electronics Camera Mechanics
Spacecraft		N/A	TBD (e.g., Spacecraft Bus)	TBD (e.g., Rate Table, Vacuum Chamber)	TBD (e.g., Rate Table, Controller)	Base Body Dynamics, Articulation Dynamics 3-D Visualization
Mission Profile		NAIF Toolset	N/A	N/A	Trajectory Visualization	Trajectory, EPOCH
Flight Environment		N/A	N/A	N/A	N/A	Gravity, Impact, Body Ephemeris, Star Catalog Surface Maps, Telecom Link
Mission Operations		DSN, AMMOS	TBD (e.g., SFOF, DSS-13)	N/A	N/A	N/A
Test Tools		N/A	N/A		Test Console	Initialization from DNP PAD



# FST Facility Overview

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- The FST is located in building 179-(112,104)
- Equipment consists of VMEbus and CPCI embedded systems and Sparc, Ultra and SGI workstations.
- Multimedia conference facility available for team meetings.
- Current principal customers - see chart.
- Current principal sponsor is VIVO.



# FST Facility Overview

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- The facility provides a raised floor, electronic benches, rack space, and halon fire suppression system. There are no special environmental controls.
- There is secured access outside normal work hours.

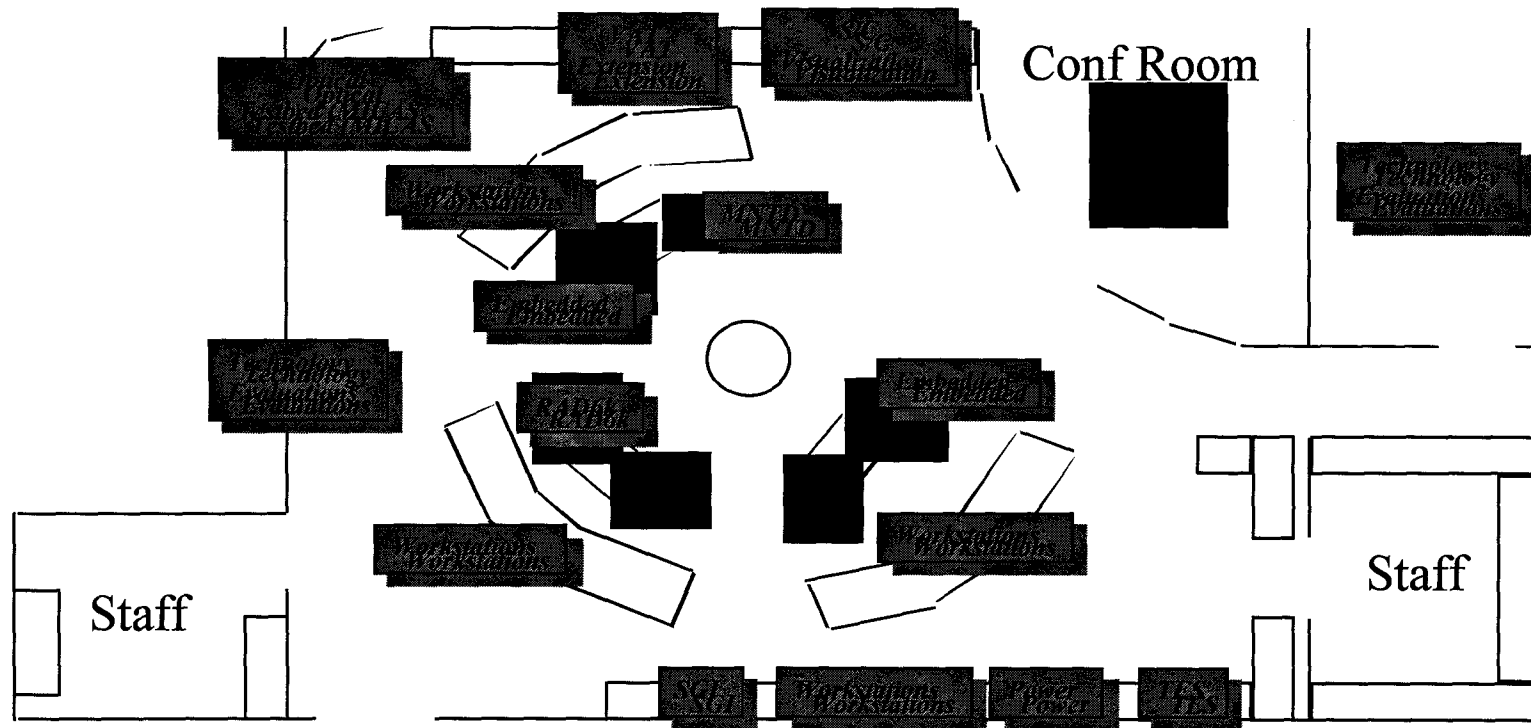


# FST Resources

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- Facility, Workstations, Network, COTS H/W
- End-to-End System-Level Testbed Framework
  - testbed architecture, configuration & control framework
  - VME, CPCI, 1553, 1773, Serial, RAD6000, HKV4F, Sun, Unix, SGI, ...
- Mission Software Development Environment
  - VxWorks, C, C++, debuggers, snoopers, analysis tools
  - configuration management, problem tracking, mailing lists, web archives
- Baseline End-to-End Information System
  - Re-useable Flight Software Components, SCPS, DSN Simulation, GDS, CFDP
- Integrated Simulators & Support Equipment
  - Dynamics Sim, Instrument Sim, Science Data Generator, Power Sim, Telecom Sim, Link Sim, Avionics Prototype
- Virtual System Verification Capability
  - Integrate models, simulators, prototypes, COTS H/W

# FST Main Facility



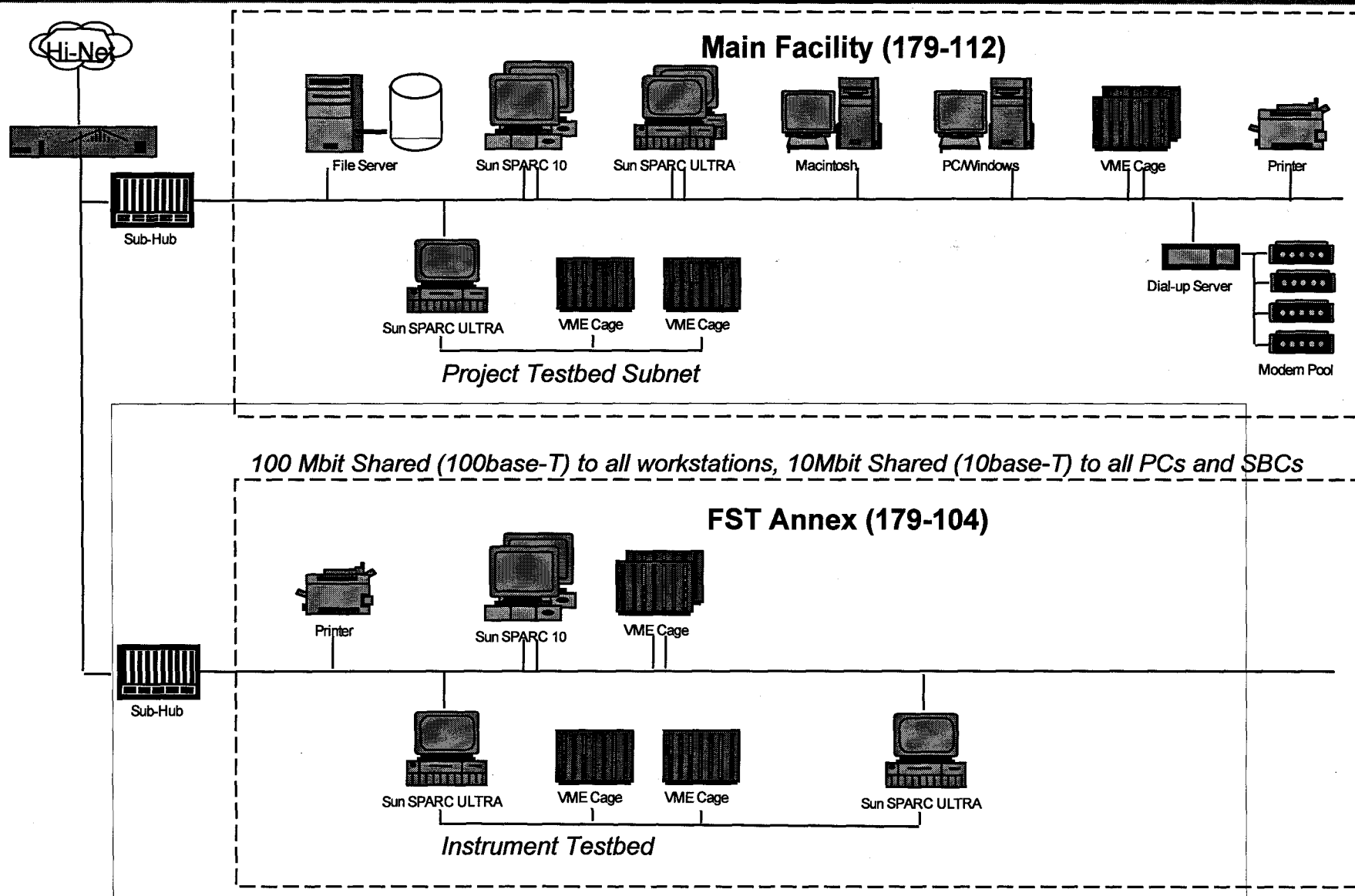


# FST Customers

FST ACTIVITY	TES	TECH-SCAT	MIRO	MARS '01	MLS	PTL	AL	X2000	DS1	APEX	ST3	MECA	MARS-RSTC	REE	GALEX	ITL
Testbed																
Design/Construction	x	x	x		x	x	x		x	x		x		x		
Procurement (HW/SW)	x	x				x			x					x	x	
R6000 Config/Setup	x		x													
VxWorks																
Consultation/Support	x	x	x	x		x		x	x	x	x	x		x	x	
Testbed Support (Ongoing)	x	x	x	x	x	x	x			x	x	x			x	
HW Eval/ Support (COTS)	x	x		x				x					x			
Facility Support	x					x										x
Customized SW Development		x							x							
General Project Support	x	x	x	x					x			x				
Tool Eval/Selection									x							
I/O Driver Support	x															
COTS HW Allocation	x								x							
Processor Benchmarking/R6000		x														
Testbed Relocation Support		x	x	x					x	x						
Remote Connectivity		x	x	x			x		x	x	x	x				



# FST Network Architecture





# FST End-to-End Testbed

## Visualization/Analysis Testbed

Location: 169  
Contact: Eric De Jong

## Simulated Mission Operations Control Center

Location: 301  
Contact: Andy Downen

## DSN Test Facility

Location: 605  
Contact: Joe Wackley

## Instrument Development Lab

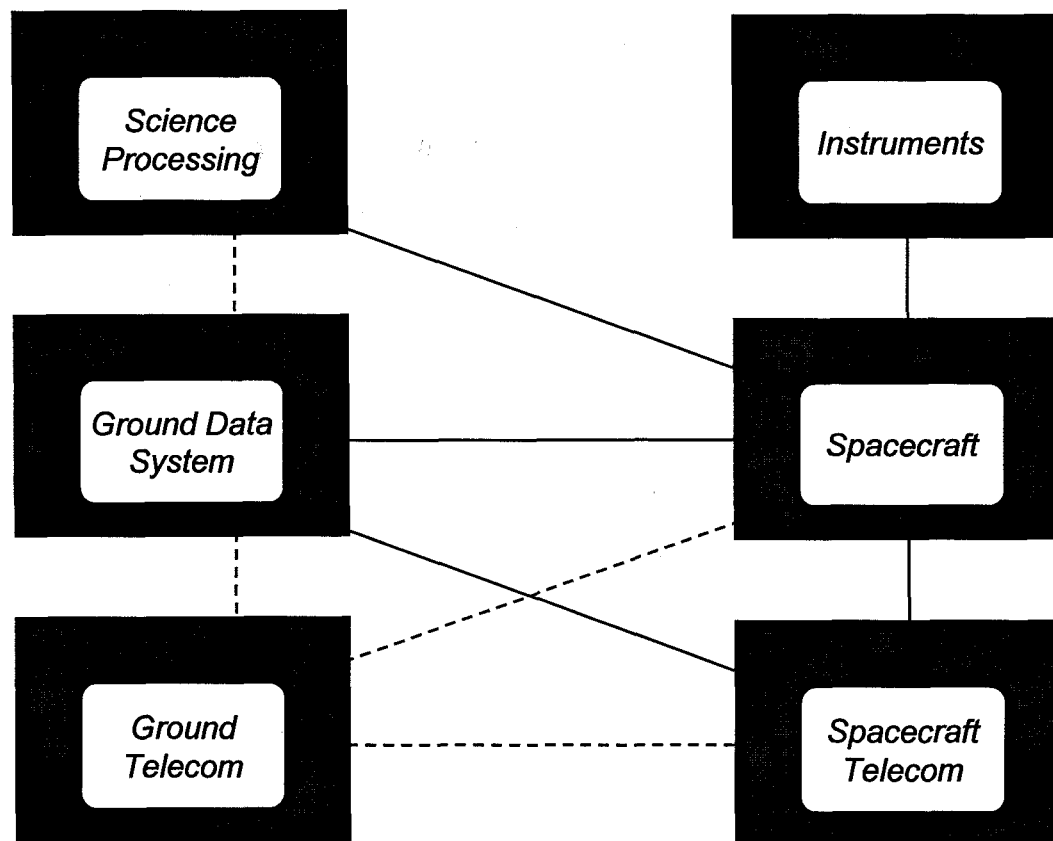
Location: 306  
Contact: Meemong Lee

## Flight System Testbed

Location: 179  
Contact: Steve Allen

## Telecommunications Development Lab

Location: 161  
Contact: Tsun-Yee Yan



(Eventually DS-T)

←-----→ Planned      ←-----→ Designed      ←-----→ Tested



# Future Plans

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- Continue to provide technical expertise to meet project needs for quick-start assistance and early life cycle prototyping activities.
- Work closely with VIVO to support process based engineering development and to act as an institutional testbed incubator.
- Develop strategies for building distributed virtual testbeds involving assets of both JPL and its industrial/academic partners.